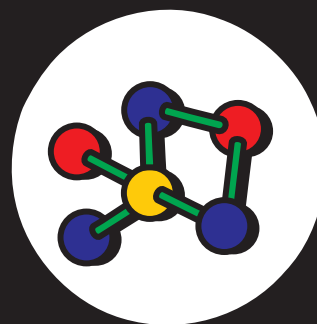


meap
Michigan Educational Assessment Program
High School Test



Science

Model of the Assessment



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April 1998
Michigan Educational Assessment Program

**MICHIGAN STATE BOARD OF EDUCATION
STATEMENT OF ASSURANCE OF COMPLIANCE WITH FEDERAL LAW**

The Michigan State Board of Education complies with all Federal laws and regulations prohibiting discrimination and with all requirements and regulations of the U.S. Department of Education. It is the policy of the Michigan State Board of Education that no person on the basis of race, color, religion, national origin or ancestry, age, sex, marital status, or handicap shall be discriminated against, excluded from participation in, denied the benefits of, or otherwise be subjected to discrimination in any program or activity for which it is responsible or for which it receives financial assistance from the U.S. Department of Education.

DIRECTIONS

In this test you will demonstrate your understanding of science. You will take the entire test in one session, and you will have at least 90 minutes to finish. You will be given additional time if necessary.

Use only a No. 2 pencil to mark your answers. Make a dark mark that fills the oval completely. If you change an answer, be sure to erase the first mark completely.

Read each question carefully. You may write in your test booklet, however, you must record answers to **all** questions in your ANSWER DOCUMENT.

There are two types of questions in this test, multiple-choice and constructed-response (open-ended). For each multiple-choice question, choose the **BEST** answer. Mark only one letter for each answer you select in the appropriate oval in your ANSWER DOCUMENT. If you skip a question, be sure to skip the corresponding number in the ANSWER DOCUMENT. Make sure the number of the question corresponds to the number in the ANSWER DOCUMENT.

For the constructed-response questions, write complete and thorough answers in the ANSWER DOCUMENT in the spaces provided for each individual item.

If you do not understand any of these directions, please raise your hand.

SAMPLE ITEMS

Sample 1 Below is a data table which shows the melting and boiling points of common substances. Study the table.

Substance	Melting Point (°C)	Boiling Point (°C)
Water	0	100
Alcohol	−117	78
Nitrogen	−210	−196
Oxygen	−218	−183

Which substance should be a *liquid* at −90 degrees?

- A water
- ✓ B alcohol
- C nitrogen
- D oxygen

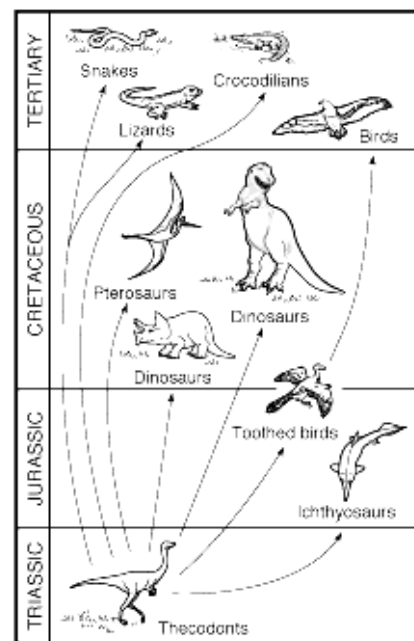
(2 points)

Sample 2 As water boils, the arrangement and behavior of the water molecules undergo changes. Describe at least two of these changes on the lines provided in your answer document.

**ANSWER THIS ITEM IN YOUR ANSWER DOCUMENT.
NOTHING WRITTEN IN THE SPACE BELOW WILL BE SCORED.**

- 1 Which of the following is an example of a relationship between a consumer and a producer?
 - A mice eating seeds
 - B snakes eating mice
 - C humans eating mushrooms
 - D plants taking nutrients from the soil
- 2 A geneticist developed two varieties of snapdragons—one with red flowers and one with white flowers. She then used pollen from the red variety to pollinate the white variety and observed that all the flowers in the next generation were red. Based on this observation, what can she conclude?
 - A The red trait is dominant.
 - B The white trait is dominant.
 - C The red snapdragons were better adapted for survival than the white snapdragons.
 - D If she had collected the pollen from the white flowers, all the flowers in the next generation would have been white.
- 3 Which of the following is **NOT** a characteristic of all living things?
 - A They require an energy source.
 - B They produce food.
 - C They contain DNA.
 - D They reproduce.
- 4 Which of these characterize all birds, reptiles, and mammals?
 - A stable body temperatures
 - B giving birth to live young
 - C internal skeletal structures
 - D predatory habits

- 5 When an animal is adjusting to a drop in air temperature, one way it can cope is to increase its metabolic rate. As the metabolic rate increases, the animal's oxygen intake will
 - A increase and carbon dioxide release will decrease
 - B decrease and carbon dioxide release will decrease
 - C decrease and carbon dioxide release will increase
 - D increase and carbon dioxide release will increase
- 6 The diagram below shows a possible evolutionary sequence for some vertebrates. Which of the following statements is best supported by the diagram?



- A Lizards and birds are both reptiles.
- B Pterosaurs and ichthyosaurs became extinct at the same time.
- C Pterosaurs evolved into birds.
- D Thecodonts were ancestors of several different types of animals.

- 7 The characteristics of some organisms are listed below.

algae - *producers*

daphnia - *herbivorous crustacean*

osprey - *carnivorous bird*

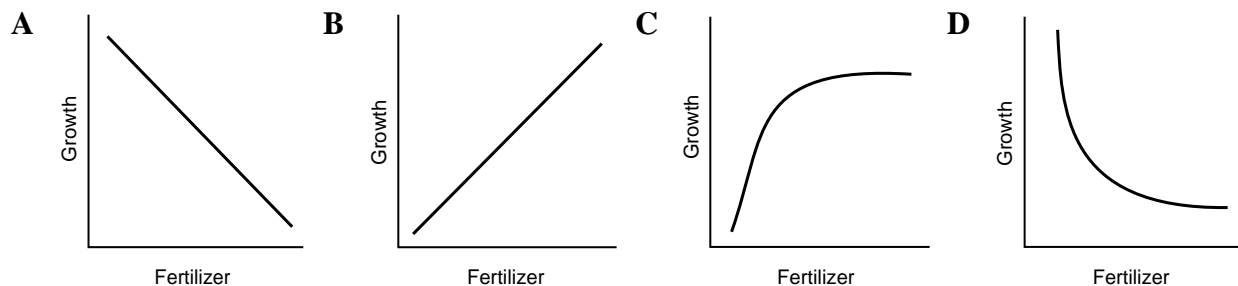
minnow - *omnivorous fish*

largemouth bass - *carnivorous fish*

Based on the information given above, which of the following food chains is possible?

- A largemouth bass—>osprey—>algae—>daphnia—>minnow
B algae—>minnow—>daphnia—>osprey—>largemouth bass
C osprey—>largemouth bass—>minnow—>daphnia—>algae
D algae—>daphnia—>minnow—>largemouth bass—>osprey

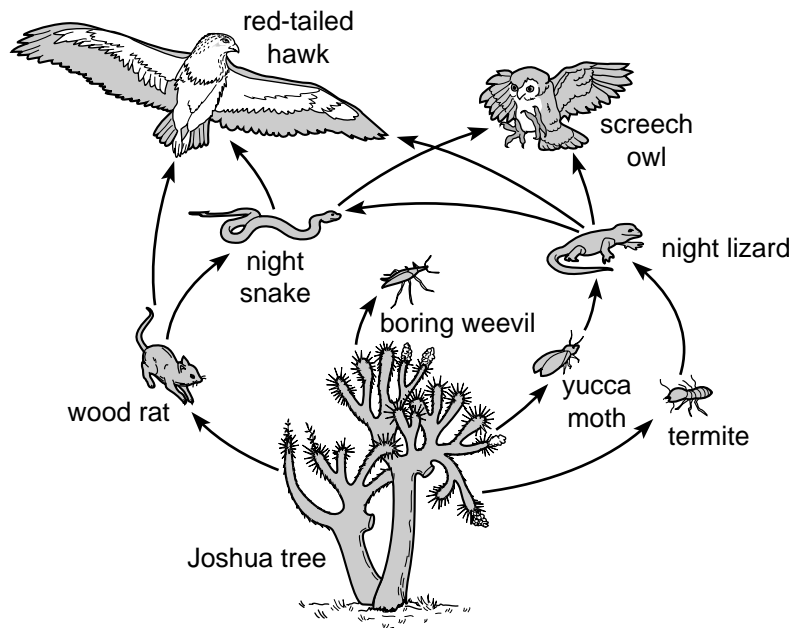
- 8 Fertilizers help plants grow faster. However, as more and more fertilizer is added, the plants may stop growing and begin to die. Which graph best illustrates this pattern?



- 9 If you get chickenpox when you are young, you are not likely to get it again. Why is this?
- A The chickenpox virus cannot enter your body again.
B The medicines you took for chickenpox are stored in your body.
C Chickenpox is not as harmful now as it used to be.
D Your body has formed antibodies against the chickenpox virus.

- 10 Which of these is a negative side effect of using pesticides on crops?
- A Crop pests are destroyed.
B The crop takes longer to mature.
C The size of the crop is reduced.
D Beneficial insects may be destroyed.

Study the diagram below of a *partial* desert food web. Then do Numbers 11 through 15.



- | | |
|---|---|
| <p>11 What do the arrows in the diagram represent?</p> <ul style="list-style-type: none"> A the flow of energy in a food web B evolution from less to more complex organisms C symbiotic relationships among desert organisms D the movement of desert organisms at night | <p>13 The night lizard might be called a “secondary consumer” because</p> <ul style="list-style-type: none"> A it feeds on a plant-eating animal B it is eaten by another animal C it eats the remains of other animals D it comes out to feed after the night snake |
| <p>12 The night snake population might increase as the result of</p> <ul style="list-style-type: none"> A an increase in the screech owl population B an increase in the yucca moth population C a decrease in the night lizard population D a decrease in the wood rat population | <p>14 Which of these is NOT a testable hypothesis?</p> <ul style="list-style-type: none"> A The yucca moth pollinates the Joshua tree. B Seeds of the Joshua tree are dispersed by wood rats. C The red-tailed hawk is the most important organism in this food web. D The boring weevil feeds on several plants in the desert. |

- 15** Air, water, sunlight, sand, soil, and rocks are non-living parts of the desert environment that support organisms in the food web. Select at least three of these non-living parts and explain how each could support an organism in the food web.

Read the following investigation carefully. Then do Numbers 16 and 17.

INVESTIGATION

Problem Do caffeinated soft drinks affect a person's ability to fall asleep quickly?

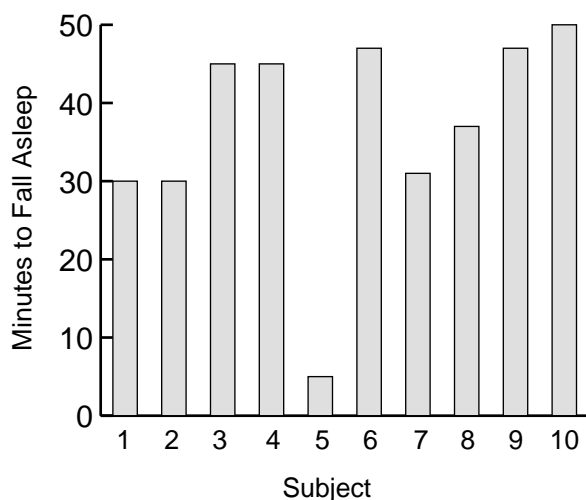
Hypothesis It will take people longer to fall asleep if they drink caffeinated soft drinks close to bedtime.

Materials 10 subjects
1 8-oz. glass of caffeinated soft drink per subject
10 notebooks
10 pencils
10 clocks

Procedure

1. Select 10 subjects to participate in this investigation.
2. Have each subject drink one 8-oz. glass of a caffeinated soft drink 1/2 hour before bedtime.
3. Every 5 minutes after going to bed, have the subjects record that they are still awake.

Results



Subject	Time to Sleep (min.)
1	30
2	30
3	45
4	45
5	5
6	46
7	31
8	37
9	46
10	50

Conclusion It takes longer to fall asleep after drinking caffeinated soft drinks.

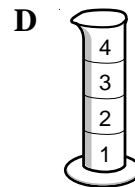
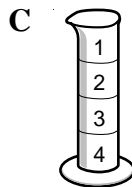
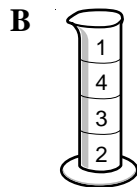
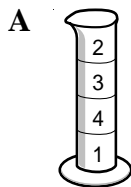
16 Identify three weaknesses in the procedure used for this investigation.

17 Describe how you would correct each of the three weaknesses you identified.

18

Liquids	Volume	Mass
Liquid 1	5 ml	3 g
Liquid 2	20 ml	6 g
Liquid 3	15 ml	5 g
Liquid 4	10 ml	4 g

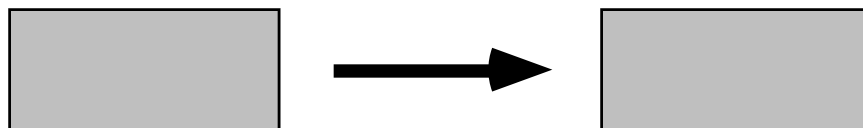
Study the table. If you pour all 4 liquids into a glass cylinder, the densest liquid will settle to the bottom and the least dense will be at the top. Which of the following represents the correct order for these liquids?



19

REACTANTS

PRODUCTS



The diagram shows a chemical equation with the substances on either side of the equation hidden from view. From the law of conservation of mass, we know that

- A** the products must weigh more than the reactants
- B** energy is neither absorbed nor released by the reaction
- C** the substances on either side of the equation must be the same
- D** the number of atoms on either side of the equation must be the same

20

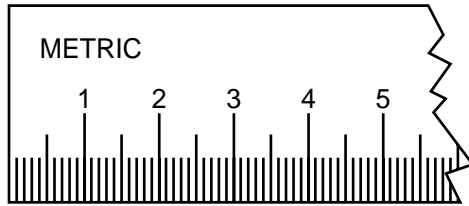
Sounds are carried by waves through air and other substances. Of the following, which is the highest-pitched sound?



- 21** “Matter is neither created nor destroyed.” This statement is a
- A** scientist’s opinion
 - B** hypothesis which cannot be tested
 - C** scientific law that has been tested
 - D** fact that does not require scientific proof
- 22** When you rub an inflated balloon against a wool sweater, the balloon may then “stick” to a wall. This is due to
- A** an increase in the number of protons on the balloon
 - B** an increase in the number of electrons on the balloon
 - C** a decrease in the number of neutrons on the balloon
 - D** a decrease in the number of protons on the balloon
- 23** When you hold an ice cube, your hand feels cold because
- A** the cold flows from the ice cube to your hand
 - B** heat flows from your hand to the ice cube
 - C** ice is a poor conductor of heat
 - D** your hand is a better conductor of heat than the ice cube

- 24** A student places a lamp with a purple light above a purple piece of cardboard and a green piece of cardboard. After 5 minutes, how would the temperatures of the two pieces of cardboard compare?
- A** They will probably be the same temperature.
 - B** The purple cardboard will probably feel warmer.
 - C** The green cardboard will probably feel warmer.
 - D** It is impossible to predict from the available information.
- 25** Many years ago, scientists concluded that matter is made up of very small particles known as atoms. Why did they accept the idea of atoms even though they could not see them?
- A** Scientists accepted the statements of wise men from early times.
 - B** Scientists had faith that they could someday see atoms.
 - C** Scientists believed that there was no need to prove that atoms exist, since matter exists.
 - D** Scientists realized that many observations were explained by the idea of atoms.

26



A student used the ruler shown above to measure the side of a square block. She recorded the length as 4.32 cm. What is wrong with her answer?

- A** She should have measured all sides of the block.
- B** She placed the decimal in the wrong place.
- C** She should have squared the answer to determine the correct length.
- D** Her ruler did not allow measurement as precise as 4.32 cm.

27

A																		E	
1 H																		2 He	
B																			
3 Li	4 Be																		
11 Na	12 Mg																		
19 K	20 Ca																		
37 Rb	38 Sr																		
55 Cs	56 Ba																		
87 Fr	88 Ra																		

In the periodic table, the number above the symbol for each element represents

- A** the number of neutrons in an atom of the element
- B** the number of protons in an atom of the element
- C** the combined number of protons and neutrons in an atom of the element
- D** the combined number of protons and electrons in an atom of the element

Below is a data table which shows the melting and boiling points of common substances. Study the table. Then do Numbers 28 through 32.

Substance	Melting Point (°C)	Boiling Point (°C)
Water	0	100
Alcohol	-117	78
Nitrogen	-210	-196
Oxygen	-218	-183

28 Which substance should be a *liquid* at -90 degrees?

- A** alcohol
- B** water
- C** nitrogen
- D** oxygen

29 As each substance in the table is cooled down, the atoms and molecules undergo a

- A** physical change as they move faster.
- B** physical change as they move slower.
- C** chemical change as they move faster.
- D** chemical change as they move slower.

30 Because alcohol freezes and boils at lower temperatures than water, mixing alcohol and water could be a useful application for a

- A** clean and inexpensive alternative to gasoline.
- B** clean and inexpensive alternative to gasoline.
- C** better radiator coolant in cars during the summertime.
- D** better windshield-washer fluid in cars during the wintertime.

31 In order to change water from a solid to a liquid, energy must be

- A** removed.
- B** created.
- C** added.
- D** destroyed.

- 32** As water boils, the arrangement and behavior of the water molecules changes. Describe at least two of these changes on the lines provided below.

Read the following article carefully. Then do Numbers 33 and 34.

GARLIC and HEALTH

Garlic may be your best defense against a host of ailments, including joint pain, hardening of the arteries, high cholesterol, low blood sugar, colds, flu, and sore throat.

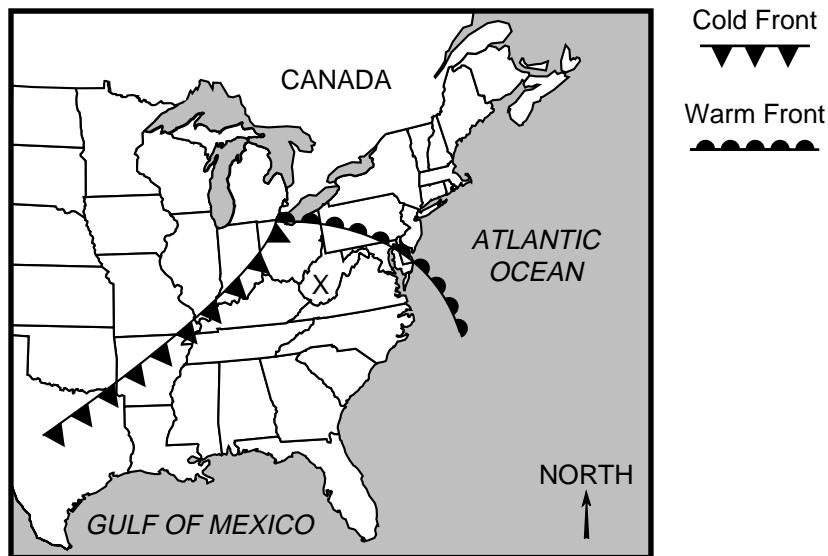
Retired professional clown Lester Gross, 77, of Gilroy, California, is very enthusiastic about garlic. “Garlic’s health-boosting ingredients certainly helped to improve my overall health and build my immune system. A stroke forced me to change my lifestyle. I was no longer active. I quit appearing at clown parades, children’s parties, and charity events. This made me very unhappy. Then I began taking garlic tablets on a daily basis. Now I rarely catch colds or flu and no longer suffer the crippling pain of arthritis. Amazingly, even my cholesterol level has dropped from 249 to 202. Today, I have lots more energy and engage in more activities. My muscle tone has improved as well as my outlook,” he says.

- 33** What kind of evidence provided in the article supports the claim that garlic helps prevent many illnesses?

Would you say that this claim is a fact or hypothesis? In your response, be sure to explain your answer.

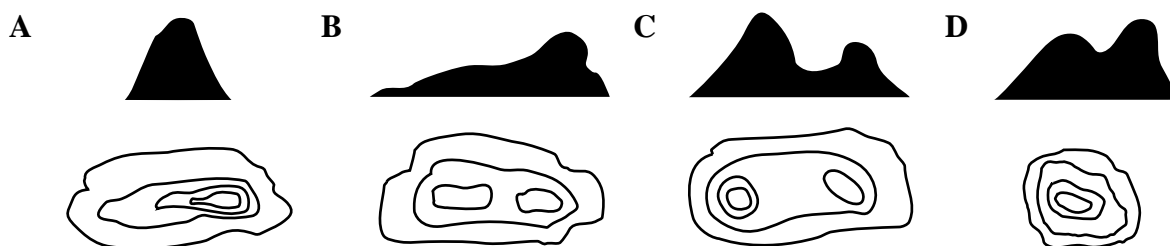
- 34** List one scientific procedure that would cause **SCIENTISTS** to be more likely to accept this claim.

- 35 Use the weather map to answer the question that follows.

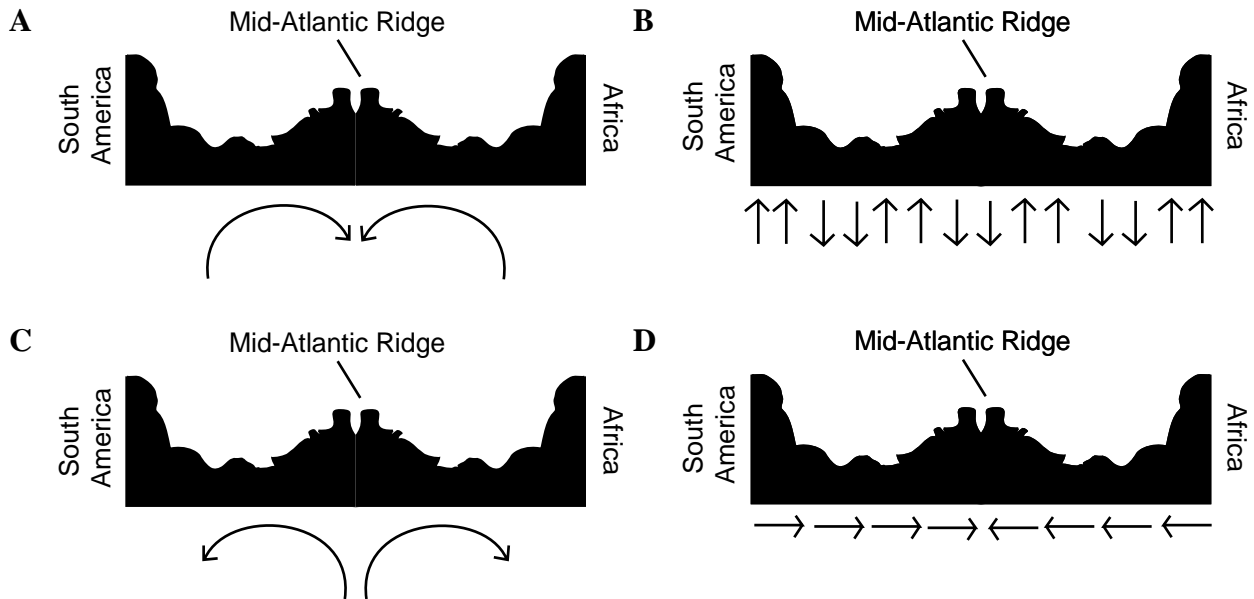


The air mass located at point X most likely originated over the

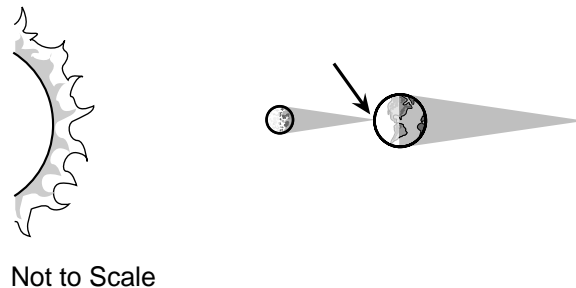
- A central part the United States
 - B central part of Canada
 - C Gulf of Mexico
 - D Pacific Northwest
- 36 Which cross-section most closely matches the contour map below it ?



- 37 Many scientists believe that convection currents in the mantle between South America and Africa caused the separation of the two continents and the formation of the Mid-Atlantic Ridge. Which diagram best represents the currents described in their theory?



38



Based on the diagram above, an observer on Earth, at the location indicated by the arrow, might witness a

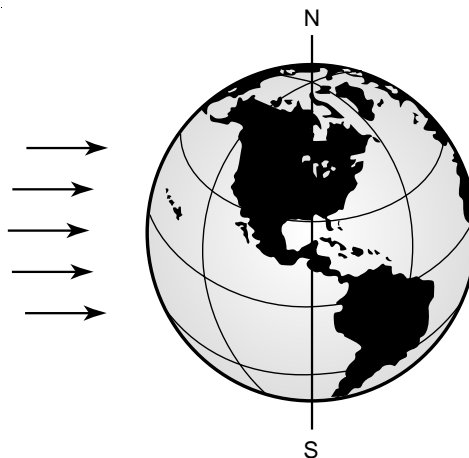
- | | |
|------------------------|------------------------|
| A half moon | B full moon |
| C lunar eclipse | D solar eclipse |

- 39 The arrows in the diagrams represent rays of sunlight striking Earth. Which diagram shows how Earth's axis is tilted when it is summer in the *Southern Hemisphere*?

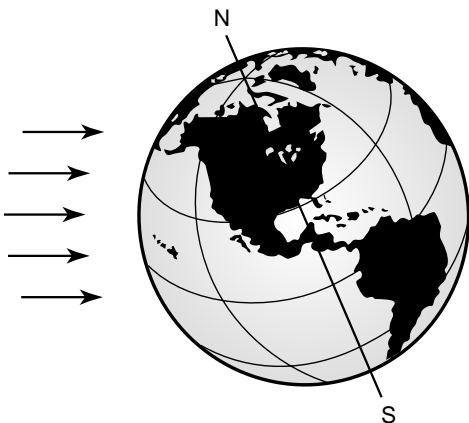
A



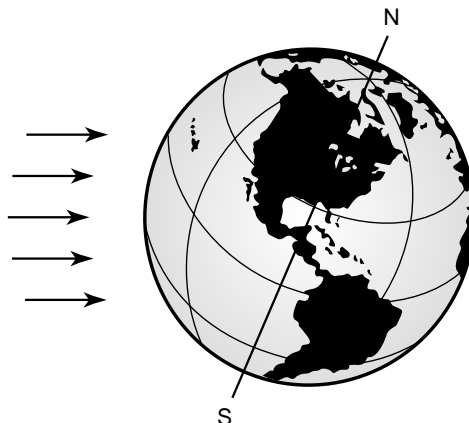
B



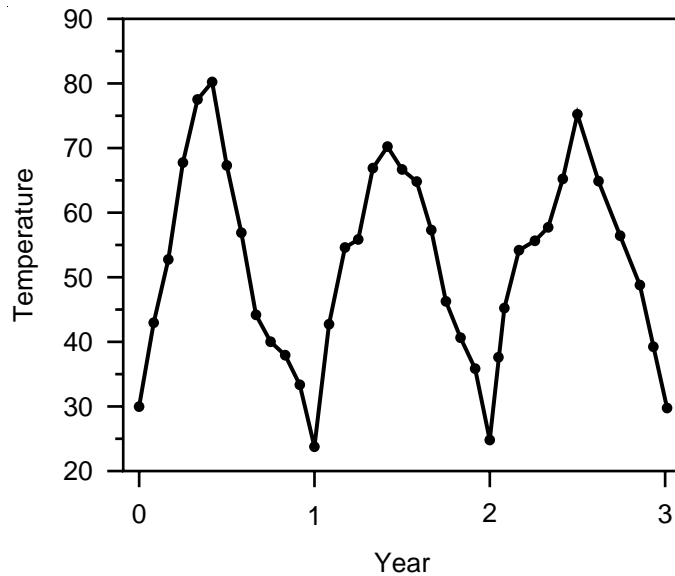
C



D



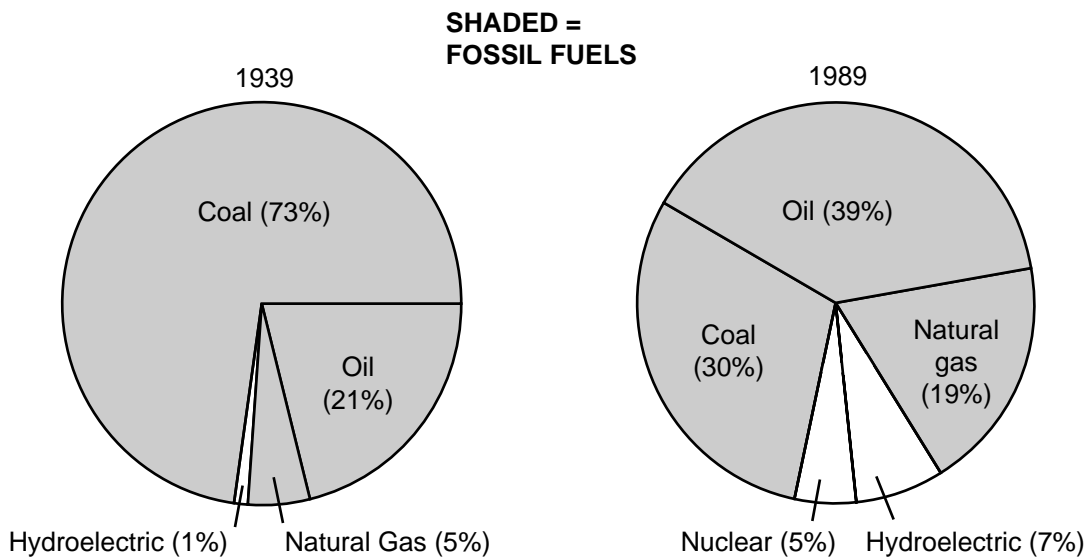
40



The graph above shows the average monthly temperatures at one location on Earth over a three year period. The pattern shown in the graph is

- A random
- B steadily decreasing
- C cyclic
- D steadily increasing

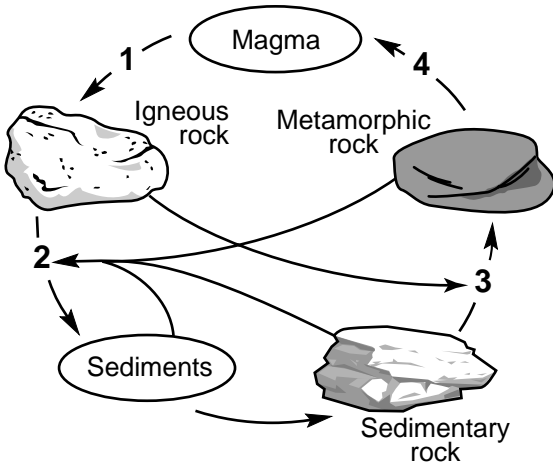
41



According to the pie charts above, which of the following statements is true?

- A In 1939 a greater percentage of energy was obtained from hydroelectric dams than in 1989.
- B Fossil fuels made up a greater percentage of total energy use in 1939 than in 1989.
- C Coal represented a larger percentage of the total energy use in 1989 than in 1939.
- D The percentage of natural gas used has decreased over time.

42



Number 3 in the rock-cycle diagram indicates a process of

- A weathering, erosion, transportation, and deposition
- B chemical change due to heat and pressure
- C cooling and solidifying
- D melting under extremely high temperature

43

The large boulders frequently found in Michigan in sandy fields and woods

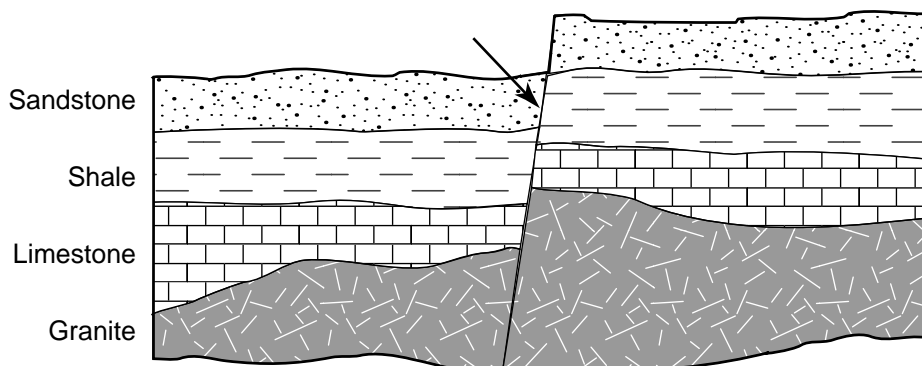
- A were formed in their present position by soil compaction
- B were formed in their present position by volcanoes
- C were transported to their present position by glaciers
- D were transported to their present position by floods

44

Which of the following statements can **NOT** be tested by scientific study?

- A Nuclear power plants in Michigan release fewer pollutants into the air than fossil fuels do.
- B The combustion of fossil fuels releases carbon dioxide into the air.
- C Solar energy panels in Michigan release fewer pollutants than fossil fuels do.
- D Fossil fuels should be avoided because it is wrong to pollute the air.

Study the following diagram. Then do Numbers 45 through 49.



- 45** Order the top three rock layers from oldest to most recent.

A sandstone, shale, limestone
B limestone, shale, sandstone
C shale, limestone, sandstone
D sandstone, limestone, shale

46

Rock Layer	Thickness of Layer	Time Required for Deposition
Sandstone	300 feet	1.5 million years
Shale	400 feet	2.0 million years
Limestone	200 feet	2.0 million years

According to the table above, you can conclude that the

A limestone layer was deposited most rapidly
B shale layer was deposited most rapidly
C shale and limestone layers were deposited at the same rate
D sandstone and shale layers were deposited at the same rate

- 47** Data collected from seismographs would be most useful for

A estimating the age of Earth
B calculating the moon's gravitational influence on Earth
C monitoring a volcano which is about to erupt
D measuring the elevation of mountains

- 48** The feature indicated by the arrow most likely occurred as a result of

A cementation
B sedimentation
C earthquake activity
D volcanic eruption

- 49** Which of the four layers of rock shown in the diagram might contain fossils? In your response, be sure to explain why **EACH** of the four layers could or could not contain fossils.

MICHIGAN HIGH SCHOOL PROFICIENCY TEST

MODEL ASSESSMENT

SCIENCE

ANSWER KEY

1	L15-ENERGY/ECOSYSTEM006	A
2	L09-GENETICS 001	A
3	L01-CLASSIFY 001	B
4	L06-CLASSFY ORGANISM001	C
5	L08-FOOD STORAGE/USE001	D
6	C1-CONSTRUCTING 001	D
7	L15-ENERGY/ECOSYSTEM001	D
8	C1-CONSTRUCTING 002	A
9	R1-EVIDENCE/REASON 001	D
10	L19-AGRICULT & ECO'S001	D
11	L15-ENERGY/ECOSYSTEM003	A
12	L16-POPULATION SIZE 001	B
13	L15-ENERGY/ECOSYSTEM004	A
14	C1-CONSTRUCTING 003	C
15	L15-ENERGY/ECOSYSTEM005	**
16	C1-INVESTIGATION 007	**
17	C1-INVESTIGATION 008	**
18	P02-MASS/VOLUME 001	A
19	P08-CONSRVTION/MASS 008	D
20	P18-SOUNDS/WAVES 001	A
21	R1-EVIDENCE/REASON 003	C
22	P14-MACHINES/FORCE 001	B
23	P11-ENERGY CHANGES 001	B
24	P20-COLORS/LIGHT WAV001	C
25	C1-CONSTRUCTING 005	D
26	C1-CONSTRUCTING 004	D
27	P03-ELEMENT FAMILIES005	B
28	C1-CONSTRUCTING 006	A
29	P10-ATOMIC CHANGES 005	B
30	R1-EVIDENCE/REASON 004	D
31	P18-SOUNDS/WAVES 002	C
32	P10-ATOMIC CHANGES 006	**
33	TEXT CRITICISM	**
34	TEXT CRITICISM	**
35	E14-WEATHER/STORMS 001	C
36	E02-USE MAPS 001	C
37	E03-SHAPING LANDFORM001	C
38	E18-EARTH/PLANETS 001	D
39	C1-CONSTRUCTING 007	D
40	C1-CONSTRUCTING 008	C
41	C1-CONSTRUCTING 009	B
42	E04-HOW ROCKS FORM 001	B
43	E01-FEATURES:GRT LKS001	C
44	R1-EVIDENCE/REASON 008	D
45	E04-HOW ROCKS FORM 003	B
46	E05-GEOLOGIC HISTORY002	D
47	R1-EVIDENCE/REASON 009	C
48	E03-SHAPING LANDFORM002	C
49	R1-EVIDENCE/REASON 007	**

**Constructed-Response Items.